(12) PATENT (11) Application No. AU 200050863 B2
(19) AUSTRALIAN PATENT OFFICE (10) Patent No. 780685

(54) Title
Material for use in a fluid transfer system

(51)[6] International Patent Classification(s)
E02B 011/00

(21) Application No: 200050863 (22) Application Date: 2000.05.31

(87) WIPO No: WO00/73593

(30) Priority Data

(31) Number	(32) Date	(33) Country
9912652	1999.06.01	GB
9925498	1999.10.29	GB

(43) Publication Date : 2000.12.18
(43) Publication Journal Date : 2001.03.01
(44) Accepted Journal Date : 2005.04.14

(71) Applicant(s)
Econoplas Limited

(72) Inventor(s)
John Alexander Gaskarth

(74) Agent/Attorney
Halford and Co.,No 1 Market Street,SYDNEY NSW 2000

50863/00

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
7 December 2000 (07.12.2000)

PCT

(10) International Publication Number
WO 00/73593 A1

(51) International Patent Classification[7]: E02B 11/00

(21) International Application Number: PCT/GB00/01968

(22) International Filing Date: 31 May 2000 (31.05.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
9912652.6 1 June 1999 (01.06.1999) GB
9925498.9 29 October 1999 (29.10.1999) GB

(75)
~~(71)~~ Applicant and
(72) Inventor: **GASKARTH, John, Alexander** [GB/GB]; Low Rigg, Stainsacre, Whitby, North Yorkshire YO22 4LP (GB).

(74) Agent: **VINSOME, Rex, Martin**; Urquhart-Dykes & Lord, St Nicholas Chambers, Amen Corner, Newcastle-upon-Tyne NE1 1PE (GB).

(71) Econoplas Limited, 61 Borough Road, Middlesborough, Cleveland TS1 3AL. (GB).

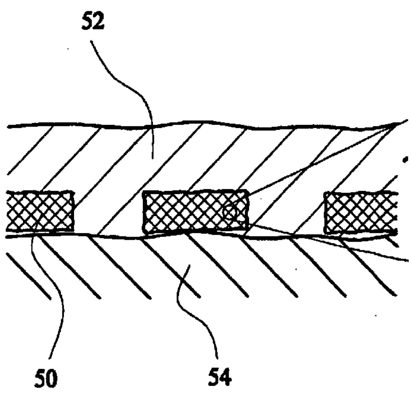
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: MATERIAL FOR USE IN A FLUID TRANSFER SYSTEM



(57) Abstract: A material for use in a fluid transfer system is disclosed. The material comprises one or more cured thermoset materials, and/or one or more fibrous materials, and one or more thermoplastic materials melded thereto. The material is used in conjunction with pipes or gutters to produce systems for fluid transfer, in particular systems for drainage and/or irrigation.

WO 00/73593 A1

MATERIAL FOR USE IN A FLUID TRANSFER SYSTEM

The present invention relates to a material for use in a system for transferring fluid, and to a fluid transfer system incorporating such a material. The invention relates particularly, but not exclusively, to a material for use in a drainage and/or irrigation system.

Underground drainage/irrigation systems are known in which an underground pipe having slits, respectively carries water away from/to an area of ground to be drained or irrigated. Such systems suffer from the drawback that mud and silt can enter into the pipe and cause blockages, or the slits in the pipe can become blocked by debris.

When laying such a pipe considerable care is required in maintaining a constant gradient to allow the water to pass in or out. Therefore obstacles in the ground, such as rocks or tree roots, have to be avoided and the back filling of trenches dug to lay the pipes in must be undertaken with great care.

Care when back filling is also required as such pipes can become distorted, compressed or ruptured. This can lead to direct blockage, or to inconsistent drainage or irrigation and an increased likelihood of blockage occurring due to siltation as described above.

Such pipe systems cannot be located close to trees or hedges as the roots of such plants can infiltrate the pipes. Once within a pipe, the root system grows rapidly in the water rich environment and can quickly lead to blockages.

A further problem associated with pipe systems is that as the diameter of a pipe is increased, the quantity of material required to construct a pipe of sufficient strength to protect against compression dramatically increases. This in turn significantly increases the cost of the pipe.

All such pipes can also succumb to compression forces from the surface, such as experienced from increasing heavy farm machinery, and are prone to collapse. This problem is accentuated around areas of most frequent use, such as gateways.

Preferred embodiments of the present invention seek to overcome the above disadvantages of the prior art.

According to an aspect of the present invention, there is provided a fluid transfer material for use in a system for transferring fluid, the material comprising:

at least one cured thermoset material; and/or

at least one fibrous material; and

at least one thermoplastic material melded thereto.

By providing a thermoplastic material melded with or bonded to at least one fibrous material and/or at least one thermoset material, this provides the advantage of providing a fluid transfer material through which fluid can pass, but which prevents passage of larger particles such as stones or gravel, which could otherwise cause blockages in pipes.

At the same time, the fluid transfer material can be constructed with a relatively rigid open structure, which enables the fluid transfer material to be sufficiently strong and durable while still allowing fluid to pass therethrough. The thermoset material is used to provide rigidity, and resilience to compressive forces. The fibrous material is provided to assist the thermoset material in creating an open structure. In time the fibrous material may decay and further assist in creating an open structure.

At least one said thermoset material may be chopped, shredded or fragmented.

This provides the advantage of enabling the fluid transfer material to be formed into a large sectional, relatively solid material, which has a porous structure. By forming the material into a structure of large surface area in this way, the further advantage is provided of enabling the fluid flow through the material to be maximised, while at the same time enabling some solid contaminants particularly large contaminants to be filtered. Furthermore, to create an increase in the overall size of the fluid transfer structure, without a decrease in strength of the structure, the above described embodiment of the present invention does not require a significant increase in material used in its construction and as a result its cost, when compared to that required in pipe systems.

At least one thermoset material may comprise rubber.

At least one said thermoset material may be recycled from motor vehicles.

At least one said fibrous material may comprise straw.

At least one said fibrous material may comprise wood.

At least one said fibrous material may be inorganic.

At least one said thermoplastic material may be recycled.

The use of the above waste or recycled materials provides the advantage of utilising low cost raw materials, while at the same time providing a use for many materials which present difficulties in recycling. The thermoset material used may be reclaimed materials from the vehicle dismantling industry or from car tyres which at present are costly to dispose of. Fibrous materials such as straw also present disposal problems, in particular linseed and rape straw which rot much more slowly than other straws. The thermoplastics may also be recycled, and mixed source thermoplastics may be used. The use of mixed source thermoplastics has the further advantage that unlike many conventional thermoplastic recycling techniques, which require a relatively high level of purity of recycled material, almost any thermoplastic can be added to the mixture to facilitate the bonding or melding together of the other materials.

These benefits of low cost raw materials provide the further advantage that the volume of the material to be used is not restricted by cost, thus enabling extensive drainage to be carried out on heavy, wet land.

At least one said thermoplastic material may be chopped or shredded.

In a preferred embodiment, the material is moulded.

In another preferred embodiment, the materials are mixed together, preheated and placed into mould where they are melded together.

In a further preferred embodiment the materials are heated by hot gas.

Alternatively, the material may be formed by an extrusion process at elevated temperature.

In a preferred embodiment the material is at least partially surrounded by netting.

Preferably, the netting is in the form of a fine mesh.

By providing a net around the material, the advantage is provided that an additional filtering of particulate matter occurs prior to fluid passing into the material. This will therefore reduce the quantity of suspended solids within the effluent discharged from the material, making the effluent more suitable for discharging in watercourses or for providing drinking water for livestock. Furthermore, the netting will reduce the risk of blockage within the material and therefore extend its life.

In preferred embodiments said material further comprises mica or vermiculite.

By adding mica or vermiculite to the fluid transfer material the advantage is provided that the material retains some water within it the structure, longer than when such materials are not present, and is able to give this material up later. This provides the advantage when the material is used for irrigation or as a rooting media for use in hydroponics that water has a longer retention time within the material.

According to another aspect of the present invention, there is provided a system for transferring fluid comprising:

a conduit for carrying fluid; and

a material as defined above, the material cooperating with said conduit for transferring fluid thereto and/or therefrom.

In a preferred embodiment, said conduit is a gutter arranged in use below an elongate length of said fluid transfer material.

The conduit may be an elongate pipe having means for enabling passage of fluid between the interior and exterior thereof, said pipe being at least partially surrounded by an elongate length of said fluid transfer material.

The means for enabling passage of fluid between the interior and exterior of the pipe may comprise one or more apertures in the pipe.

The pipe may have at least one slot arranged in an upper part thereof in use.

The pipe may be porous.

Such a system may be used as a more efficient alternative or supplementary to back filling of trenches dug to lay drainage/irrigation pipes in. Such a system has the important advantage of protecting the pipe from compressive forces. The system can also filter and minimise the passage of solid contaminants in drainage water before they can be introduced to the pipe.

The system may be for drainage.

Alternatively, or in addition, the system may be for irrigation.

According to a further aspect of the present invention, there is provided a method of making a fluid transfer material comprising the steps of:-

mixing together at least one thermoset material and/or at least one fibrous material and at least one thermoplastic material to form a mixture;

placing said mixture in a mould; and

heating said mixture so as to cause the melding of said at least one thermoplastic material to the other materials.

A preferred method further comprises the step of preheating said mixture before it is placed in said mould.

In a further preferred method the heating of said mixture is heated by the introduction of a heated gas into the mixture.

According to another aspect of the present invention there is provided a method of making a fluid transfer material comprising the steps of:-

mixing together pieces of thermoplastic materials having differing melt points and/or of differing sizes;

heating said thermoplastics so as to cause the at least partial melting of at least some of said thermoplastics, and thereby meld at least some said thermoplastics to at least some other thermoplastics; and

cooling said thermoplastics so as to form a substantially rigid material having a continuous porous structure throughout its volume.

By providing a method as outlined above the advantage is provided that a fluid transfer material having the advantages set out above can be provided using only thermoplastic materials.

Preferred embodiments of the invention will now be described, by way of example only, and not in any limitative sense, with reference to the accompanying drawings, in which:-

Figure 1 is a schematic perspective view of a cross-section view of a drainage and/or irrigation system of a first embodiment of the present invention;

Figure 2 is a view, corresponding to Figure 1, of a system of a second embodiment of the invention;

Figure 3 is a view, corresponding to Figure 1, of a system of a third embodiment of the invention;

Figure 4 is a view, corresponding to Figure 1, of a system of a fourth embodiment of the invention;

Figure 5 is a schematic perspective view of a drainage and/or irrigation material of a fifth embodiment of the present invention;

Figure 6 is a detailed schematic view of a part of the material of Figure 5;

Figure 7 is a schematic perspective view of a drainage and/or irrigation material of a fifth embodiment of the present invention;

Figure 8 is a detailed schematic view of a part of the material of Figure 7.

Referring to Figure 1, an irrigation and/or drainage system 1 comprises a generally cylindrical pipe 2 having slots (not shown), the pipe 2 being surrounded by an elongate length of a fluid transfer material 3 formed from a moulded mixture of shredded thermoplastics, shredded thermoset materials and organic and/or inorganic fibre. As can be seen form the Figure, the width of the length of material 3 is considerable greater in the region above the pipe 2 than in the vicinity of the pipe 2. This enables the material 3 to capture fluid from (or deliver fluid to) a large volume of ground.

Figure 2 shows a second embodiment of the irrigation and/or drainage system 11, which differs from the embodiment of Figure 1 in that the material 13 is of generally circular transverse cross section with the pipe 12 arranged at a lower part thereof.

Referring to Figure 3, a drainage and/or irrigation system 31 of a third embodiment comprises an elongate gutter 32 arranged below an elongate length of the fluid transfer material 33 described with reference to Figures 1 and 2 above and having the same shape as the material 3 of Figure 1. Similarly, the material 43 of the embodiment of Figure 4 has the same shape as the material 13 of figure 2.

Referring to Figure 5, a drainage/irrigation material 50 is placed at the boundary between the top soil 52 and subsoil 54.

Referring to Figure 6, the material 50 comprises thermoset 60 and fibrous material 62 which is melded together with thermoplastic material 64 such that interstices or air holes 66 are formed between the materials. It is through these interstices 66 that in use the fluid being drained or irrigated flows.

Referring to Figure 7, a drainage/irrigation material 70 is placed in a trench 72. Soil removed to create trench 72 will be replaced to cover the material 70.

Referring to Figure 8, the material 70 comprises thermoset 80 which is melded together with thermoplastic material 84 such that interstices or air holes 86 are again formed between the materials, and through which the movement of water occurs.

Any of the above described embodiments of the present invention may be produced by moulding. A combination of the thermoplastics and at least one of the fibrous and thermoset materials are heated to a temperature above the melt point of the dominant thermoplastic of the mixture, mixed and being placed in a mould. The mixture is heated in the mould by the introduction of hot air, providing an even distribution of heat. The heating of the thermoplastics allows them to meld or bond with themselves and with the other materials. The material is then allowed to cool and set. The cooling process can be speeded by the introduction of liquid nitrogen. Ultrasonic, infrared or microwave heating techniques may also be used to reach the required melt point temperature.

In order for the thermoplastics to meld with the other materials, it is necessary that the pieces of thermoplastics melt at least sufficiently so as to able to weld themselves to other thermoplastics and/or the other materials.

The above described embodiments can also be produced by extrusion. Hopper fed, straight barrel, straight screw, in-line or cross-head extruders are suitable systems for producing such materials. The speed of production and pressure used within the extruder can be varied to produce various densities (ie more open or compact structure) of products for use in different circumstances and purposes. Again liquid nitrogen can be used to assist in the cooling process, and ultrasonic heating techniques may be used to heat the mixture to the required temperature for extrusion. The use of adhesives in addition or as an alternative to thermoplastics would reduce or eliminate the necessity for heating the mixture and cooling the resultant product.

Use of an extrusion process will also tend to cause a proportion of the longer fibres, whether from the fibrous material or shreds of rubber, to align along the axis of the extrusion. When the extruded product is in the ground acting as drain or irrigation means, the direction of the fibres will tend to draw water along the drainage/irrigation system by a wicking process.

Where a cross-head extruder is used a line or rope may be introduced to the middle of the product profile. Netting may also be wrapped around the outside of the product to assist in the handling of the product once manufactured. The netting may be wrapped around the outside of the product either completely or at least partially covering it. Alternatively a sleeve of netting maybe introduced.

To form elongate gutter 32, shown in Figure 3, a sheet of thermoplastic is placed on the underside of the formed profile before it is cooled. The retained heat in the newly formed profile is sufficient to meld the thermoplastic to the profile. If there is not enough residual heat, addition heat can applied to assist with the bonding process.

The material may also be used as a rooting media for hydroponics. When used for hydroponics or for irrigation, mica or vermiculite may be added to the mixture which hold some water, thereby increasing the retention time of water within the material.

It will be appreciated by persons skilled in the art that the above embodiments have been described by way of example only and not in any limitative sense, and that various alterations and modifications are possible without departure from the scope of the invention as defined by the appended claims. For example it will be appreciated by persons skilled in the art that fluid transfer systems with a high fibrous content (and low or zero thermoset content) are suitable for use as absorbent materials for substances such as oils, and can therefore be formed into oil absorbent booms for spillage control.

It will also be appreciated by persons skilled in the art that such fluid transfer systems can be used as a rooting media for plants grown by hydroponic means.

It will be further appreciated that such fluid transfer systems can be formed into mats or sections for laying under areas requiring intensive drainage and/or irrigation such as sports area including golfing greens. In another application for such a fluid transfer material a high thermoset and low or zero fibrous content material can be formed into mats or sections and used as part of a drainage system in the construction of roads.

The claims defining the invention are as follows:

1. A fluid transfer material for use in a system for transferring fluid, the fluid transfer material comprising:
   at least one cured thermoset material; and
   at least one thermoplastic material melded thereto,
   characterised in that there is sufficient thermoset material to create an open structure of the fluid transfer material.

2. A fluid transfer material according to claim 1, further comprising at least one fibrous material, of which, together with the thermoset material, there is sufficient to create said open structure of the fluid transfer material.

3. A fluid transfer material according to either claim 1 or 2, wherein at least one said thermoset material is chopped, shredded or fragmented.

4. A fluid transfer material according to any one of the preceding claims, wherein at least one said thermoset material comprises rubber, preferably from recycled tyres of motor vehicles.

5. A fluid transfer material according to claim 2, wherein at least one said fibrous material comprises straw, wood or an inorganic material.

6. A fluid transfer material according to any of one of the preceding claims, wherein at least one said thermoplastic material is recycled, and preferably chopped or shredded.

7. A fluid transfer material according to any one of the preceding claims, wherein said material is at least partially surrounded by netting, preferably a fine mesh net.

8. A fluid transfer material according to any of the preceding claims further comprising mica and/or vermiculite.

9. A fluid transfer system comprising:
a conduit for carrying fluid; and
a fluid transfer material according to any of the preceding claims, the fluid transfer material cooperating with said conduit for transferring fluid thereto and/or therefrom.

10. A fluid transfer system according to claim 9 wherein said conduit is a gutter arranged in use below an elongate length of said fluid transfer material.

11. A fluid transfer system according to claim 9 wherein said conduit is an elongate pipe having means for enabling passage of fluid between the interior and exterior thereof and said pipe being at least partially surrounded by an elongate length of said fluid transfer material.

12. A fluid transfer system according to claim 11 wherein said means for enabling the passage of fluid between the interior and the exterior of the pipe comprises one or more apertures in the pipe, or at least one slot arranged in the upper part of said pipe in use, or wherein said pipe is porous.

13. A fluid transfer system according to any one of claims 9 to 12 wherein said system is used for drainage or for irrigation.

14. A method of making a fluid transfer material comprising the steps of:-

mixing together at least one thermoset material, optionally at least one fibrous material, and at least one thermoplastic material to form a mixture;

placing said mixture in a mould; and

heating said mixture so as to cause the melding of said at least one thermoplastic material to the other materials, there being sufficient thermoset material, and fibrous material when present, to create an open structure of the fluid transfer material.

15. A method according to claim 14, further comprising the step of preheating said mixture before it is placed in said mould.

16. A method according to claim 14 or 15 wherein said mixture is heated by the introduction of a heated gas into the mixture.

17. A fluid transfer material for use in a system for transferring fluid, the fluid transfer material comprising at least one fibrous material mixed with and melded to at least one thermoplastic material.

18. A fluid transfer material according to any of claims 1 to 8, wherein said material is formed by an extrusion process.

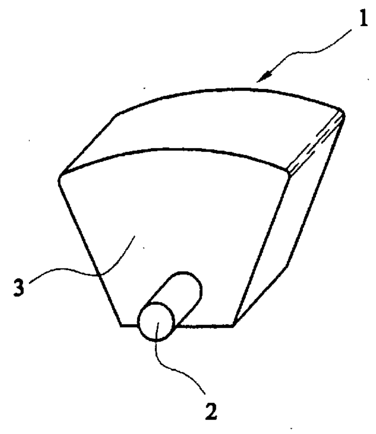


FIG. 1

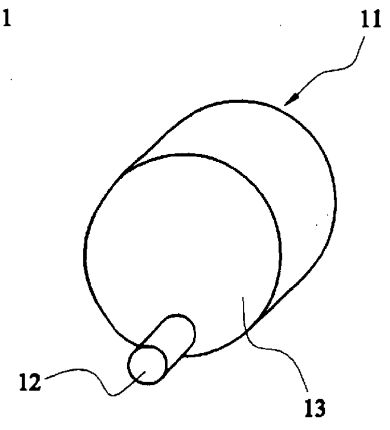


FIG. 2

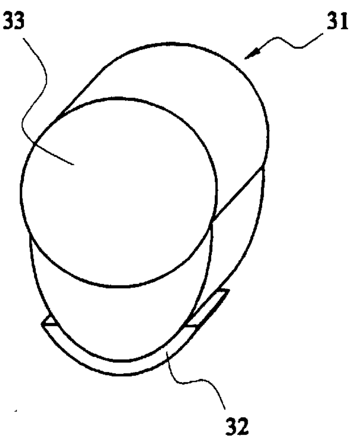


FIG. 3

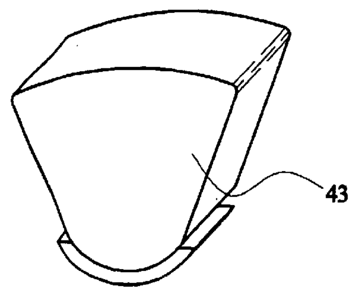


FIG. 4

SUBSTITUTE SHEET (RULE 26)

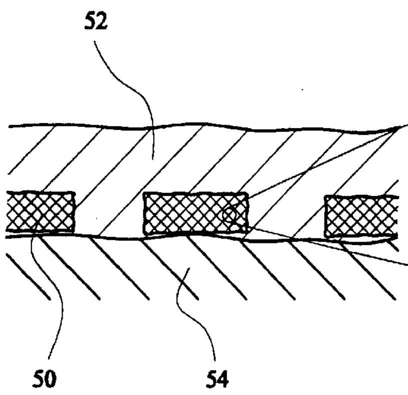


FIG. 5

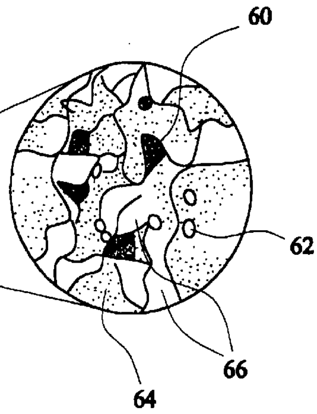


FIG. 6

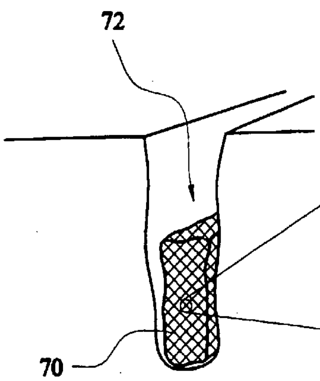


FIG. 7

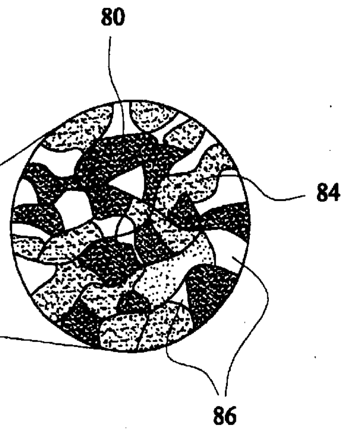


FIG. 8